question which sooner or later must occupy the attention it deserves, viz., the best means of collecting and arranging museums for the purposes of instruction.

How few of those who visit the British Museum or South Kensington, amongst the less instructed portion of the public at least, carry away any distinct reminiscence of what they have seen. The mind is bewildered by the immense number of objects presented to it and the absence of any sequence in the arrangement by which to assist the memory. The principles which are recognised as applicable to education in general apply equally to the arrangement of museums in so far as their educational functions are concerned, and consist, not in overwhelming the student with an immense accumulation of facts, but in presenting to his mind only such facts as are important or typical, and in the order in which it is intended they should be remembered. The order in which the knowledge of things is best received and retained by the memory is precisely that in which the things themselves were evolved; consequently, the arrangement which in a museum is best adapted to impart instruction is at the same time that which best records the history of the things exhibited. This consideration appears to determine conclusively the arrangement which ought to be adopted wherever the education of the public is the object to be attained, but museums, whether local or national, have other objects besides the instruction of the public. They are intended for the preservation of antiquities and natural history objects, many of which are not yet classified and have no place assigned to them, and which consequently cannot be arranged in any historic sequence such as I have alluded to. They should afford materials, not for the use of the public only, but for *savants*, in promoting original research, which is one of their most important functions, and which ought not to be sacrificed for the benefit of the common herd of visitors, and the question is, whether these distinct objects can be properly combined in one museum and by the same arrangement. If my own experience as a collector may be relied upon, this cannot be the case, unless an educational museum is collected from the first with a view to sequence, and unless this object is kept steadily in view whenever any addition is made to the collection, it will miss its aim. Take, for example, the case of the British Museum, which has accumulated from time to time by the accession of more or less homogeneous collections which have been purchased or presented, and which it is important to keep together. Out of any such collection it is probable that only a very few objects could be regarded as typical of any particular phase of development, say in pottery, sculpture, or glyptic art, and the remainder, although of the utmost value to the antiquary and necessary to be retained, would only serve to confuse any arrangement that might be made either for historic or educational purposes. Or take the case of a local museum in any large country town. Two distinct functions present themselves: on the one hand it is of use in preserving the antiquities or natural history specimens of the locality; on the other hand it should consist of general collections scientifically arranged and classified for the instruction of the people of the neighbourhood. We are brought by this to consider the advisability of having two distinct kinds of museums, which would bear pretty much the same relation to one another that a glossary of scientific terms would bear to a series of elementary treatises on different sciences—the one might be termed a museum of reference, the other an educational museum; the first arranged geographically, and the second having an evolutionary arrangement; the one special and the other general; the one arranged by finds and the other by subjects; the one comprising all the various objects that can be brought together from any particular district or country, and the other consisting only of such objects as may be selected as typical or as forming connecting links of development, the one composed exclusively of originals, and the other consisting in great part of casts, reproductions, and models. This provision, although I have placed it last in the list of distinctive functions, is by no means the least important in a practical point of view, because we see that by this means the two institutions ought never to be allowed to clash. Not only are reproductions and casts as useful as originals for the purposes of instruction, but models, in some cases, are infinitely preferable, because taking less room. Might it not serve to clear our ideas if we could arrive at the principle of utilising our existing institutions so as to serve the two distinct purposes above discussed, retaining the British Museum as a museum of reference, devoting South Kensington exclusively to the purposes of education and evolutionary arrangement, and separating the loan collections as a branch distinct from both. By this means we should be enabled to carry out the objects contemplated by Lord Wharncliffe's motion, not confining ourselves to statuary alone, but organising collections to illustrate the history of various other branches of art and industry, each commencing with the rude production of savage and prehistoric man, and ending with the complex contrivances of our own time. Each year the sums hitherto devoted to annual exhibitions would be applied to perfecting and re-arranging the collection, casting out some and replacing them by others more strictly representative in their character. The final result would be a museum of super-organic evolution worthy of the nation and of any labour that might be bestowed upon it. It might be thought, perhaps, that to carry out such a system representing any considerable number of arts and sciences, unbounded space would be requisite, but when it is remembered that the specimens would be rigidly confined to such as represented a distinct step of development, excluding all abnormal excrescences, it is evident that the number of objects required for any particular series would be limited.

My own collection of savage and prehistoric objects now exhibited at Bethnal Green has been collected upon this system during the last twenty years, and although the effectual carrying out of the plan has been limited by the means at my disposal, enough has been done to show that a considerable number of subjects may be represented without any extravagant demand on space. Weapons, pottery, early ship-building, personal ornament, carving and sculpture, musical instruments, early or savage drawings, clothing, early writing, objects illustrating the origin and use of fire, religious emblems, &c., are exhibited separately in cases occupying the basement on one side of the building, and several cases are devoted to the distribution and development of particular forms of ornament. The long rooms in the Exhibition buildings at South Kensington are admirably adapted for the extension of this system. Probably the best arrangement would be to devote the whole range of the side walls to objects laid out in historic sequence and to place in cases opposite each successive stage of art, objects belonging to existing peoples which correspond most nearly to the historic or prehistoric sequence on the opposite side; by this means both ancient and modern phases would be represented, and survivals where they occur could be traced to their sources.

A. LANE FOX

The Phonograph

IN reference to Prof. Mayer's account and Prof. Fleeming Jenkins's letters, I may say that I had an opportunity of an hour's observation of a phonograph constructed by Mr. Stroh, 42A, Hampstead Road, on April 3, at the invitation of Prof. Graham Bell. The difference between words produced from the phonograph and those spoken into it gave me the same feeling as the difference between a worn print and an early proof of an engraving. When the words were uttered loudly and slowly and repeated rather faster, it was easy to catch the sense and meaning, but I doubt whether unknown English words would be recognised, and certainly unknown foreign words would present insuperable difficulties. I should myself find the phonograph as at present constructed quite sufficient for my own purposes of registering pronunciation, especially delicate shades of dialectal utterance. Some words, as *see*, almost disappear. Both *ee* and *oo* are difficult vowels, so that Prof. Bell at first thought that the first sounded like the second, while in reality both are altered to indistinct sounds that I do not remember to have heard in speech. The resemblance is so great, however, that *bite, bout* could not be distinguished, though one ends nearly with *ee* and the other nearly with *oo*, and there is no other difference in the words. The vowels *ai*, *oa*, as in *bait*, *boat*, are also poor; *aa*, *au*, as in *baa*, *haul*, are really the only good ones. Hence I feel totally unable to speak positively as to the change of vowel quality by altering the rapidity of rotation and therefore pitch. As far as I could observe the quality did change, as it does in speech. We tried pronouncing words backwards, sometimes with good success, but as might be expected, even when the effects were recognisable, they were not always true. Thus, *aabaa*, *aadaa*, passed muster, but *aajaa* failed. The instrument is, however, not delicate enough to bring out these differences. The mechanical obstacle of the tin-foil, which has to be indented, and offers too much resistance, seems to be the cause of this. Such a word as *Scots*, when sung rapidly, at the beginning of *Scots wha hae*, degenerated almost into the simple vowel, the

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initial and final *s* were quite lost, and the action of the mutes, *c*, *t*, was almost *nil*.

The invention is highly interesting, the effects at present produced are sometimes startling (as in cries, coughs, laughter, music), the philosophy of the process (taking a permanent impression of a very complex compound vibration, and using it as a mould to reproduce that vibration) is exceedingly attractive, but at present the instrument—at least that one which I saw, differing in many respects from the one described by Prof. Mayer—has not risen beyond a lecture illustration or a philosophical toy. ALEXANDER J. ELLIS

April 13

Phoneidoscopic Representation of Vowels and Diphthongs

PERHAPS your correspondent, Mr. Sedley Taylor, would kindly test with his phoneidoscope the propriety of calling the English combinations *ea*, *ae*, *oe*, *ie* diphthongs, and the simple vowel *I*, as pronounced in the personal pronoun, a simple sound. Perhaps also the English *ā* (as in "*name*") may be regarded as a diphthong. In Otto's German Grammar, the German combinations *ae*, *oe*, *ue*, are classed as modified vowels. I fancy *oe* is a diphthong, though in rapid speech it becomes more like the simple sound *ue*. J. H. BLAKESLEY

Linden, Hannover, April 11

The Acoustical Properties of Soap Films.

IN connection with the interesting results recently obtained by Mr. Sedley Taylor upon the acoustic properties of soap-films, as exhibited in the simple and beautiful instrument which he has termed the Phoneidoscope, I should like to call attention to the following passage published in 1873 by Prof. E. Mach, of Prague, in his *Optisch-Akustische Versuche*:—

"Bei dieser Gelegenheit kann erwähnt werden, dass die Plateau'schen Flüssigkeitshäutchen sich vorzüglich zum Studium der Membranschwingungen eignen. Eine solche Flüssigkeitshaut vor eine tönende Pfeife gebracht zeigt meist mehrere Bäuche. Ein Lichtpunkt, der sich in der Membran spiegelt, gibt mehrere glanzende geschlossene Curven."

After some remarks on the low tones to which these films vibrate, and on their vibrations to the upper partial tones, the author passes on to another subject with the remark:—"Ich erwähne diese Experimente, weil sie vielleicht, weiter verfolgt, zur Beantwortung mancher Fragen über Membranschwingungen beitragen können."

There is no mention, however, of the rotating pairs of coloured vortices noticed by Mr. Sedley Taylor. Brewster appears to have observed similar phenomena (see *Edin. Trans.*, vol. xxiv, "On Colours of Soap Bubbles," &c.) as the result of directed currents of air upon films. I have found that the vortices are also produced when a small lightly vibrating tuning-fork, having its prongs previously wetted with soap solution, is made to touch a flat soap film produced in the ordinary manner. SILVANUS P. THOMPSON

University College, Bristol, April 5

Cumulative Temperature

THE idea of a clock with an uncompensated pendulum for temperature integration referred to by Mr. Cooke (NATURE, vol. xvii. p. 323 and p. 448) has probably occurred to many persons, and was proposed by me in 1840; I found, however, that it was not new then. Forbes says in his Report on Meteorology (Brit. Assoc. Report, 1832, p. 213):—"A mechanical mode of taking the mean of an infinite number of temperatures has been proposed by M. Grassman, by observing the change of rate caused by the influence of temperature upon the uncompensated pendulum of a clock (*Poggendorff*, 1825). The idea is a good one, but was proposed long ago by Dr. Brewster (' Edinburgh Encyclopædia,' art. Atmospheric Clock)." The chief merit in this matter will belong to the person who puts the idea into a working form which can be proved capable of giving accurate results.

April 9 B.

The Southern Drought

IN response to your question appended to my letter in the last number of NATURE, I am able to give you the time of the last great drought in the Gilbert Islands. In 1870 I visited these and several other islands in the South Pacific (an account of my cruise appeared in Dr. Petermann's *Mittheilungen* for June, 1871), and at that time there was a very general drought. I was among the Gilbert Islands during October, and found that no rain had fallen there for several months. The cocoa-nut and pandanus-trees, upon which the people almost entirely depend for food, were very much dried up, and the fruit upon them were small, both in quantity and in size. This drought continued for two years after my visit, and the famine became so severe that many of the people were starved to death. Had it not been for the fish they procured, it is doubtful whether any of them would have survived, for the cocoa-nut and pandanus-trees ceased to yield fruit, and the poor people were obliged to chew the roots of the trees.

Since that time I have heard of another season during which there was little rain, in consequence of which there was comparative scarcity, but this was not to be compared with the great drought of 1870-1872.

I regret to say no long-continued observations on the rainfall have been made in Samoa. My own time was so fully occupied with other matters, during my residence there, that I neglected this one. As the droughts there have not been great enough to cause anything like distress, the periods of their occurrence have, unfortunately, not been recorded. S. J. WHITMEE

Blackheath, April 5

Research in Libraries

BEFORE this "voice from Australia" can reach London, I hope that some steps will have been taken towards carrying out Dr. Mallet's valuable suggestion (NATURE, vol. xvi. p. 457) so far as regards the British Museum and other leading European libraries.

The benefit of the proposed arrangement would, I am sure, be felt in Australia as much as in America. Anybody living here, in the North of Queensland, who may wish to consult a scientific book must take a sea voyage of 700 or 1,100 miles at a cost of 16*l.* or 20*l.* in money and at least a fortnight or three weeks in time. It may happen that one has a busy friend in the library city who will undertake the search through good-nature, but most people would prefer to employ a competent man who would do so as a matter of business.

Should the trustees or directors of the great libraries hesitate (and they may) to accept the responsibility of recommending searchers, probably it would answer nearly as well if the searchers were to advertise references to well-known scientific or literary men. Perhaps a hint might be taken from the Register House in Edinburgh. Titles to land in Scotland require registration for their completion. A purchaser, to satisfy himself that the seller has not previously alienated or burdened the subjects, has to overhaul the books of the register. This is done for him as a rule by professional searchers, some of whom are official and some unofficial. The system has worked admirably for some centuries I believe. Any Scotch lawyer could explain its details.

The subdivision of labour suggested by Dr. Mallet would enable a much higher use to be made of the system than the mere hunting-up of references. For example, if there were a searcher in Paris—a well-read geologist—to whom I could intrust an order for "any references in French geographical works bearing on the date of the erosion of the terrace between the Queensland coast range and the Pacific," or some such information, what possibilities would open out to the dwellers in distant isles, nay, even to the comparatively privileged inhabitants of London itself? ROBERT L. JACK

Geological Survey Office, Townsville, Queensland, Jan. 14

Mimicry in Birds

WITH reference to the correspondence on this subject which has recently apeared in NATURE, may I add the following instance, which has fallen under my own observation?—

On the coast of Kent is a tract of land protected from the sea by an embankment of shingle, and known as the "Reculver Marsh." It is frequented by skylarks and ring-plovers. Almost all these larks have incorporated the well-known alarm note of the plovers into their song. With such distinctness is this double note brought in, that the first time I heard it I could with difficulty convince myself that it was not uttered by *Ægialitis hiaticula*.

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